

FlexChassis ATCA-SH141 (13U, 14-slot AC/DC Chassis)

User Manual

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Revision History

| Revision | Description | Date |
|----------|--|---------|
| 0 | Initial User Manual | 9.08.09 |
| 1 | <ul style="list-style-type: none">• Updating section 2.1.6 to clarify “redundancy” description of AC power inlets• Added Revision History to document | 9.09.09 |
| 2 | <ul style="list-style-type: none">• Updated pictures of chassis and DC PEM | 1.26.10 |
| 3 | <ul style="list-style-type: none">• Addition of PEM Wiring (see 2.1.7) | 2.25.10 |
| 4 | <ul style="list-style-type: none">• Pictures update• Additional details on Power• Front board ID address list fix | 12.9.10 |

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Safety Instructions



This symbol indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.

General Safety Practices

Before handling the board, read the instructions and safety guidelines on the following pages to prevent damage to the product and to ensure your own personal safety.

- Always use caution when handling/operating the board. Only qualified, experienced, authorized electronics service personnel should access the interior of the equipment. The power supplies produce high voltages and energy hazards, which can cause bodily harm.
- Use extreme caution when installing or removing components. Refer to the installation instructions in this document for precautions and procedures. If you have any questions, please contact Technical Support.
- Always follow the procedural instructions for component removal and replacement in sequence.

Power



Beware Electrical shock hazard before any attempt to service the device be sure that the device is electrically isolated!!!

High voltages are present inside the chassis when the unit's power is plugged into an electrical outlet. Turn off system power, turn off the power supply, and then disconnect the power cord from its source before removing the chassis cover.

Turning off the system power switch does not remove power to components.

Make sure the work environment is grounded, and use a grounding wrist strap when handling the product.

ESD Safety Practices

Many components described in this document can be damaged by electrostatic discharge (ESD). Follow the precautions described here and before specific procedures in the document to protect static-sensitive components from ESD-related damage.

Static electricity can harm system boards. Perform service at an ESD workstation and follow proper ESD procedure to reduce the risk of damage to components. It is encouraged to follow proper ESD procedure, which can include wrist straps and smocks, when servicing equipment.

Take the following steps to prevent damage from electrostatic discharge (ESD):

- When unpacking a static-sensitive component from its shipping carton, do not remove the component's antistatic packing material until you are ready to install the component in the system. Just before unwrapping the antistatic packaging, be sure you are at an ESD workstation or grounded. This will discharge any static electricity that may have built up in your body.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components at an ESD workstation. If possible, use antistatic floor

pads and workbench pads.

- Handle components and boards with care. Don't touch the components or contacts on a board. Hold a board by its edges or by its metal mounting bracket.
- Do not handle or store system boards near strong electrostatic, electromagnetic, magnetic, or radioactive fields.

About this Document

This document provides technical information for the FlexChassis ATCA-SH141.

It is intended for technical staff tasked with installing, setting up and configuring the system, and providing troubleshooting assistance and servicing.

Related Documents



For information on the Shelf Manager, see the document entitled “Shelf Manager for FlexChassis ATCA-SH141 (13U AC/DC, 14-slot)” at

http://www.ccpu.com/support/downloads/chassis/Shelf_Manager_for_FlexChassis_ATCA_SH141_CC08106.pdf.

Instructions relating to software installation and documentation for application software development for this platform are available in the Shelf Manager External Interface Reference Manual from Pigeon Point.

Information about PICMG (PCI Industrial Computer Manufacturers Group) and the ATCA standard may be accessed on the PICMG Web site at <http://www.picmg.com>.

Style Conventions

| | |
|---|--|
| HelveticaNeueLT std | Regular text. |
| Arial Bold | Commands, keys and other parts of the user interface. |
| <i>Arial Italics</i> | Names of classes, methods, arguments, exceptions, properties, etc. Also used for special terms, the first time they appear. |
| Monospace | Text displayed on the LCD or on a computer attached to the product. |
|  | Notes, which offer an additional explanation or a hint on how to overcome a common problem. |
|  | Warnings, which indicate potential safety hazards regarding product operation or maintenance to operator or service personnel. |

1 Introduction

This chapter includes a summary of the FlexChassis ATCA-SH141. For acronyms used in this document see Section 5.3.

1.1 FlexChassis ATCA-SH141

The FlexChassis ATCA-SH141 offers the reliability and availability of the Telco-grade standards in a package, where maximum possible performance (backplane interconnect bandwidth, power levels and thermal capabilities) is provided in the shelf.

The FlexChassis ATCA-SH141 has been developed based on the accumulated knowledge and experience in the implementation of the ATCA standard since its inception in 2001, while incorporating the latest technologies available.

The SH141 uniquely offers greater computing density in its ability to fit three 14-slot shelves to be mounted on a standard 42U rack, while maintaining cooling performance of 300W per slot. It incorporates the latest technologies available to reduce its price while maintaining performance and reliability. The system offers optional redundancy for power input and management functions.

All shelf assemblies are designed using Field-Replaceable Units (FRUs), thus enabling easy and fast field maintenance with minimum or no downtime, availability of 99.999%.

In addition, a cable-holder frame can be fitted to both side-mounting flanges of the shelf (see Section 2.1.12).

The FlexChassis ATCA-SH141 is designed to comply with FCC, and CE certification, and with UL, NEBS Level-3 and ETSI.

The FlexChassis SH-141 fully complies to AdvancedTCA, PICMG 3.0 R2.0, and IPMI v 1.5.

See Section 5.2 for detailed system specifications.

1.2 Part Number

| Part Number | Module |
|-------------|---|
| 5-02981 | FlexChassis ATCA-SH141, 13U, ATCA, AC/DC combo, 40G, 14 slot, (4) fan trays, air filter; designed to accommodate (but does not include) 3x front AC PSUs or 2x rear PEMs. |

2 Understanding the Shelf Components

This chapter summarizes the functional features of the FlexChassis ATCA-SH141, and describes in further detail each of the components as well as the shelf system cooling mechanism.

The system was designed to withstand extreme conditions (to meet rigid Telco requirements). It is designed to incorporate Field-Replaceable Units (FRUs), and is fully field-serviceable.

2.1 Platform Components

A typical platform consists of the following key components:

- **19-inch rack mount shelf** — Base hardware element of the platform, which holds all the components together.
- **Card cage** — Portion of the shelf that holds the modules that are plugged into the backplane. Mechanically compliant with all aspects of PIMG 3.0.
- **Backplane** — Supports 1 to 14 ATCA-compliant front boards, and the complementary rear transition modules (RTMs). The backplane provides a Fabric Interface, and direct mating to the PEMs and to the redundant Shelf Manager board.
- **DC Power-Entry Modules (PEMs)** - 2 redundant and hot-swappable -48 VDC PEMs: Supply system power to the shelf and its components.
- **AC Power Supply Units (PSUs)** - Up to three (3) redundant, field replaceable, 100 VAC to 240 VAC, 1500watt, power supplies.
- **Optional - 6 AC Power Supplies system** - Up to 6 redundant and hot-swappable 100-240 VAC, 1500w power supplies. Chassis height grows to 14U. In AC configuration, the 14U is capable of supporting more power and provide full redundancy.
- **Fan tray** - Hot-swappable, provides front-to-back cooling, and provides N+1 fan trays redundancy cooling to components on the front and rear of the shelf.
- **Air filter tray** — Keeps the airflow free of dust and particles.
- **Blank Panels** — For non-occupied slots and for air flow management.
- **Shelf ID Board (EEPROM)** – Field replaceable shelf identification information cards.
- Shelf inlet temperature sensor
- Front lower cable management
- Front upper cable management
- Rear cable management

2.1.1 Shelf and Boards

Figure 1 shows the block diagram of the shelf and figures 2 and 3 show front and rear views of the shelf with key components highlighted.

Shelf Manager Card IPMB A,B Connection

ATCA Back Plane

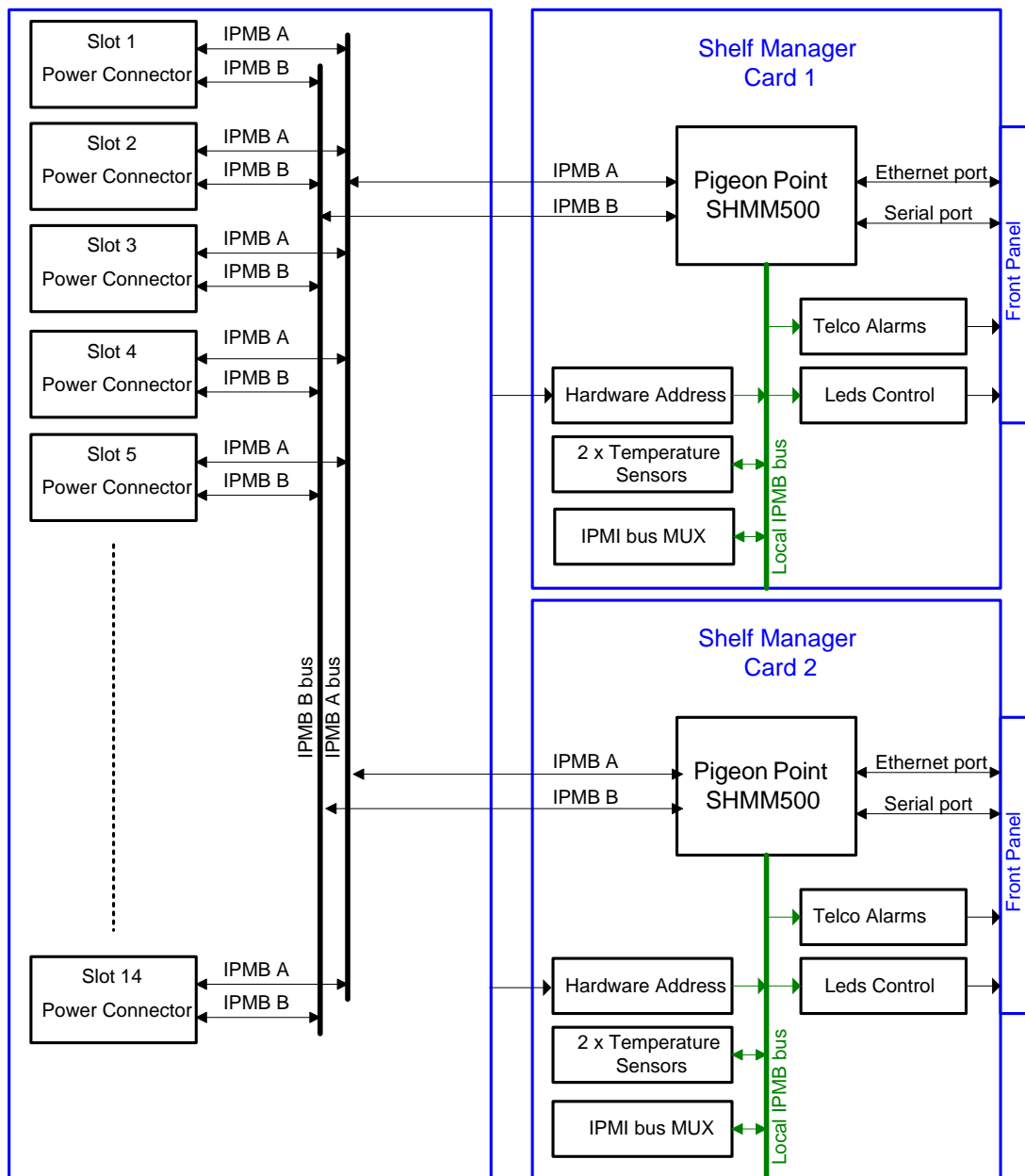


Figure 1 – IPMB interconnection Diagram

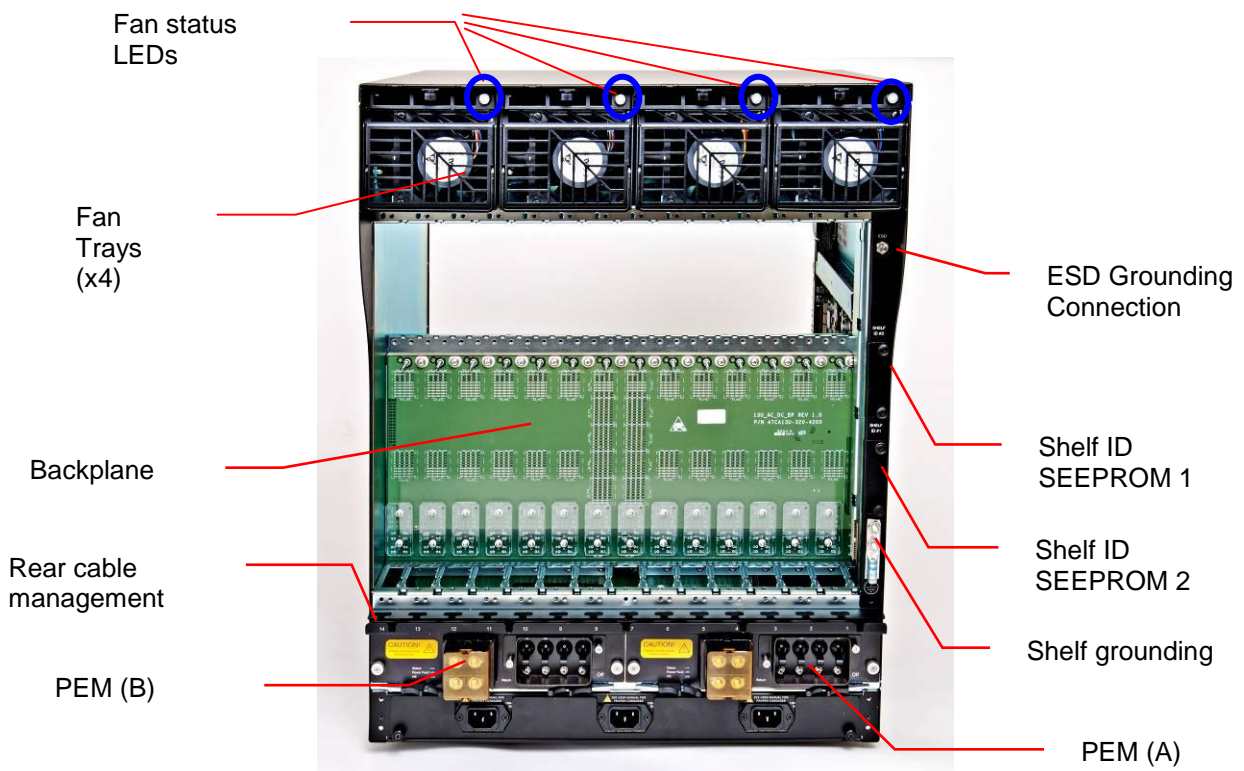
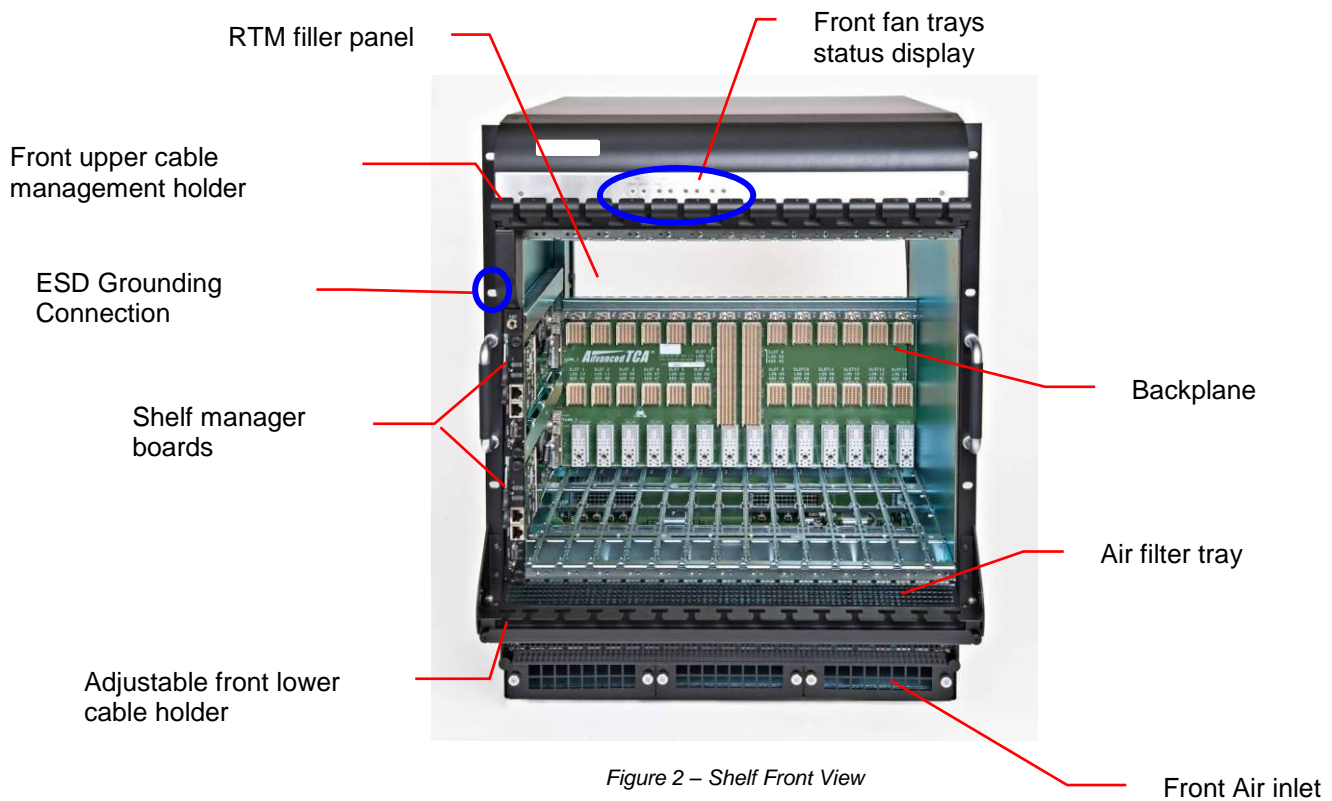




Figure 4 – 13U Chassis



Figure 5 – 14U Chassis w/ Redundant AC Power

2.1.1.1 Removable FRUs

- PEMs – two Power Entry Modules
- PSUs – three/six Power Supplies Units
- Shelf Management – two Shelf Manager boards
- Shelf ID: identical modules SEEPROMs, each host contains data about the shelf, such as:
 - serial number and manufacturer – and about the board's setup
 - shelf thermal budget and slot population.

2.1.2 Card Cage

The shelf's card cage is composed of:

- The backplane
- Top and bottom guide rails to hold the front and rear cards that plug into the backplane.

The card cage supports 14qty 8U front boards, and 14qty 8U RTMs.

The guide rails in the card cage incorporate *electrostatic discharge* (ESD) clips, as defined by *PICMG 3.0 R2.0 AdvancedTCA™* standard.

2.1.3 Backplane

2.1.3.1 Features

The ATCA PICMG 3.0-compliant backplane provides interconnectivity between the FRU's and shelf's front blades. It conforms to the *PICMG 3.0 R2.0 AdvancedTCA™ Base and fabric Specification*. Backplane features include:

- 14 slots
- Two hub slots: 7 & 8
- Fabric interface with dual-star interconnect.

- The Fabric Interface grid consists of eight differential pairs per channel; The Base Interface grid consists of four differential pairs per channel.
- Dual-star Ethernet signaling environment on the Base interface
- Bussed IPMI
- Update channel between slots 1&3, 2&4, 5&9, 6&10, 7&8, 11&13, 12&14
- Connection capacity for up to 14 ATCA-compliant front boards, as well as to the redundant Shelf Manager board, power supplies and Power Entry Modules.
- Full compliance with AdvancedTCA™ electrical and mechanical specifications
- Interconnect for system power for 14 slots.

There are no active components on the backplane, and no removable or serviceable parts on the backplane board.

The backplane has two functionally-distinct parts: bottom and center-top:

- Bottom backplane (consists of Zone 1 connectors) – dual-power connections, power connections from the two PEMs/three power supplies are independently supplied to each card plugged into the backplane. The PEMs also include circuit breakers that protect the backplane power connections from an electrical short; the PEMs are manageable thru the IPMB bus by the Shelf Manager boards.
- Center-top backplane (consists of Zone 2 connectors) – connectivity for the Base, Fabric, and update-channel interface.

2.1.3.2 Update-Channel Connections

The update channels are backplane connections between pairs of front cards that operate on a redundant basis. Application software can use the update channel for redundancy interlock, or to provide a direct connection that bypasses the (indirect) fabric interface.

If you configure a pair of front cards to use the update channel for redundancy support, you must insert the two modules into slots linked by an update channel.

Figure 6 shows the update channel connections.

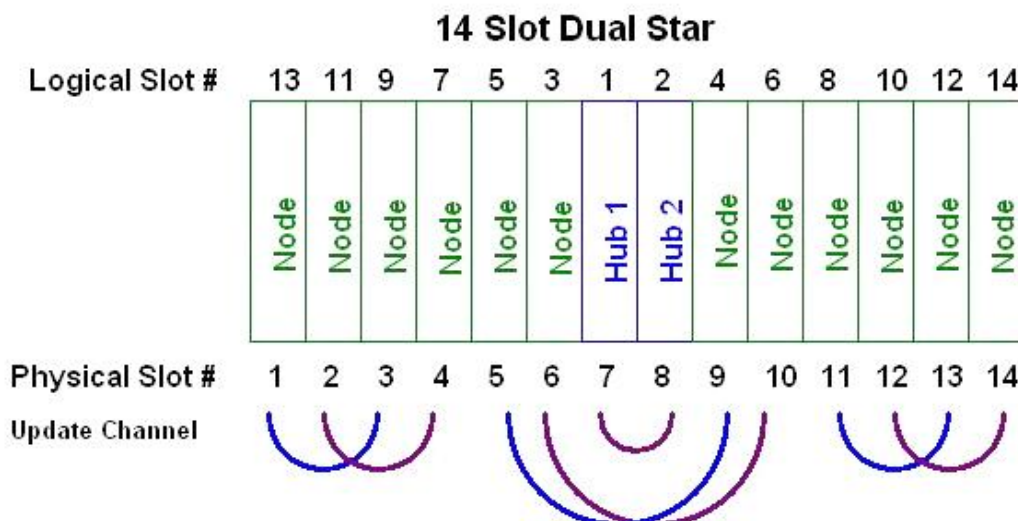


Figure 6 – Slot Allocations

Each update channel consists of 10 differential-pair connections. If an update channel connects two modules that are not identical, the Shelf Manager disables the update channel between them.

2.1.3.3 Base interface

The Base interface comprised of a single row of signal pins for a total of four signal pairs per Base interface. In total the Base interface contains up to 14 Base channels for a total of 56 possible signal pairs per board/slot. A Base channel can be used to support a 10/100/1000BASE-T Port comprised of four signal pairs.

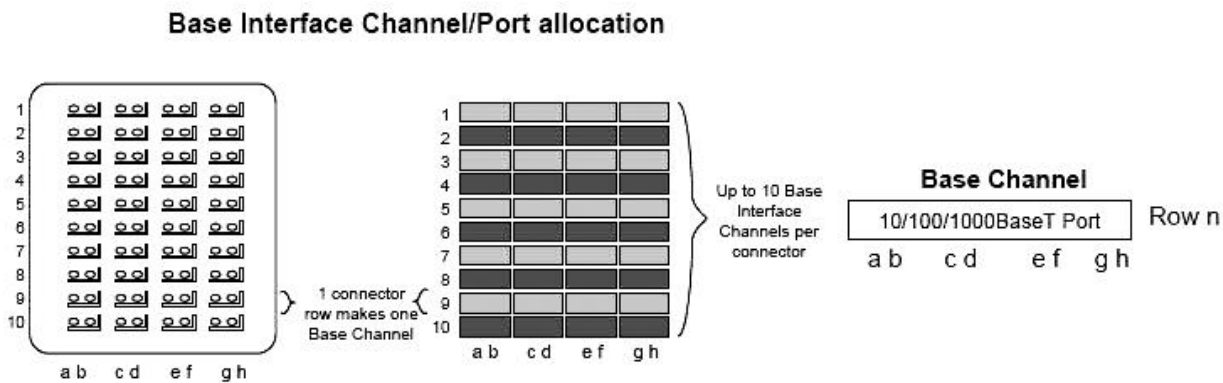


Figure 7 - Base interface channel

2.1.3.4 Fabric interface

The Fabric Interface allocates signal pairs differently than the Base Interface. A Fabric Channel is comprised of two rows of signal pairs for a total of eight signal pairs per Channel. Thus, each connector supports up to five Channels available for Board to Board connectivity. A Channel may also be viewed as being comprised of four 2-pair Ports.

2.1.3.5 Synchronization Clock Interface

The backplane supports a set of synchronization clock buses that can exchange synchronization timing information. This synchronization can be used for system-wide and intersystem synchronization purposes, which are important in some applications, such as those involving synchronous time division multiplex (TDM).

| Row # | Interface | Px20 Connector Pairs | | | | | | | |
|-------|-----------------------|----------------------|----------|----------|----------|----------|----------|----------|----------|
| | | ab | | cd | | ef | | gh | |
| 1 | Clks | CLK1A+ | CLK1A- | CLK1B+ | CLK1B- | CLK2A+ | CLK2A- | CLK2B+ | CLK2B- |
| 2 | Update channel & Clks | Tx4(UP)+ | Tx4(UP)- | Rx4(UP)+ | Rx4(UP)- | CLK3A+ | CLK3A- | CLK3B+ | CLK3B- |
| 3 | | Tx2(UP)+ | Tx2(UP)- | Rx2(UP)+ | Rx2(UP)- | Tx3(UP)+ | Tx3(UP)- | Rx3(UP)+ | Rx3(UP)- |
| 4 | | Tx0(UP)+ | Tx0(UP)- | Rx0(UP)+ | Rx0(UP)- | Tx1(UP)+ | Tx1(UP)- | Rx1(UP)+ | Rx1(UP)- |

Figure 8 – Synchronization clock and update channel pin assignments

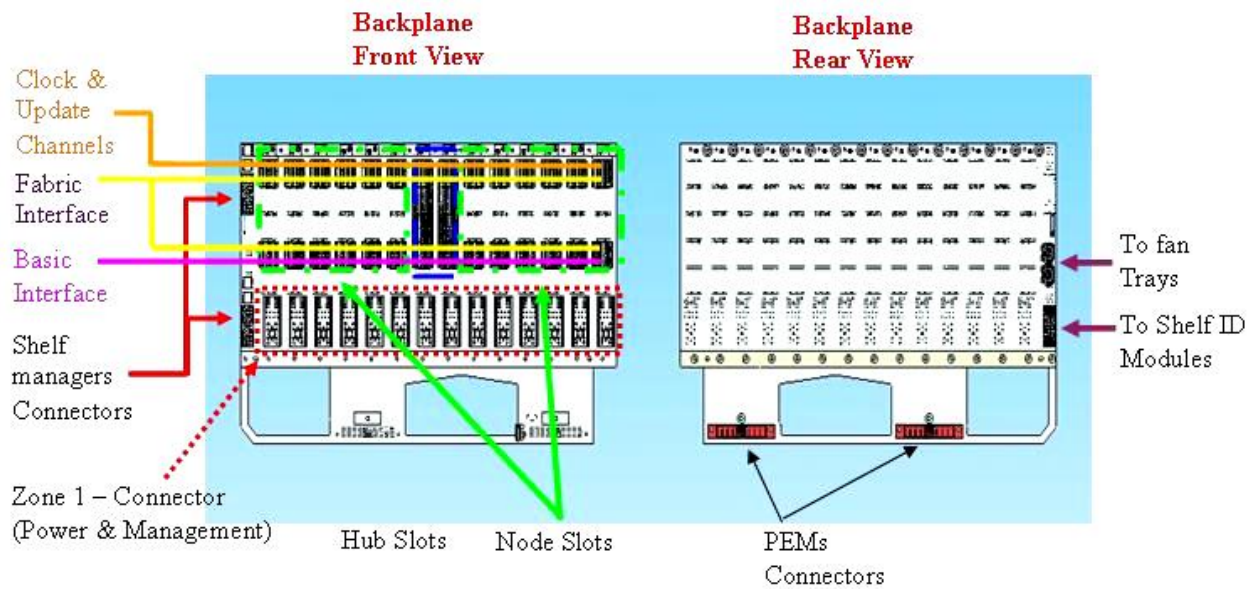


Figure 9 - Backplane Layout

2.1.4 Front Card Slot Identification

The shelf is compliant with PICMG 3.0 R2.0, and accepts front & rear cards compliant with this standard.

Figure 10 illustrates the locations of the module slot allocations when viewed from the front. The physical and the logical slot allocations are not the same for this shelf: the Physical slots are numbered 1 to 14 from left to right.

The following table shows the hardware addresses in relation to the slot numbers and slot addresses. Slots are shown in the same order as they appear in the shelf: slot 2 on the right of slot 1.

| Logical Slot Number | Hardware Address (8 bit format) | Hardware Address (7 bit format) |
|------------------------|------------------------------------|------------------------------------|
| 1 | 82h | 41h |
| 2 | 84h | 42h |
| 3 | 86h | 43h |
| 4 | 88h | 44h |
| 5 | 8ah | 45h |
| 6 | 8ch | 46h |
| 7 | 8eh | 47h |
| 8 | 90h | 48h |
| 9 | 92h | 49h |
| 10 | 94h | 4ah |
| 11 | 96h | 4bh |
| 12 | 98h | 4ch |
| 13 | 9ah | 4dh |
| 14 | 9ch | 4eh |

Figure 10 - Shelf Addressing

2.1.5 Shelf Manager Board

The shelf manager controls and manages the chassis. It controls the fans speed, monitors temperatures across the chassis, manages the hot swap insertion and extraction of modules and blades and performs multiple other tasks and functionalities. For more information, please refer to the separate Shelf Management Board user manual.

2.1.6 AC Power Supply

The field replaceable and hot swappable, 1000 VAC to 240 VAC, power supplies are providing power to the shelf.

The FlexChassis ATCA-SH141 is equipped with redundant AC power inlets which are located in the rear. There is one power inlet per power supply. If one power inlet fails the others will still function.

Each power supply is capable of supplying 1500w. Three power supplies are capable of supplying the power consumed by a fully occupied shelf.

Please note that one power supply is not capable of energizing a fully loaded chassis. The number of power supplies should be calculated based on the actual load of the chassis boards while taking into account the redundancy needs.

Calculating the number of power supplies by using the following equation (the left should be greater than the right side of the equation):

$$\text{No of PSU} \times 1440 \text{ watt} > \sum \text{power per slot} + 800 \text{ watt}$$

Where:

- 800watt is the peak power for all fan trays and shelf managers at full speed
- 1440watt is the power that each PSU is capable to supply continuously
- \sum power per slot – is the sum of power for all the blades which are used in the system.

The SH141 can also be ordered with space to host up to 6 AC power supplies, required for cases where redundancy and/or additional power is needed. In this case, the chassis height will grow to 14U.

The power supplies are located in the lower part of the shelf. Each power supply has its own front-back independent cooling. In order to comply with NEBS GR63 Core the power supplies have separate removable air filters.

The AC inlet connectors are located on the rear of the shelf. When AC PSUs are installed, DC PEMs should be removed and in their place Power Distribution Boards will be installed.

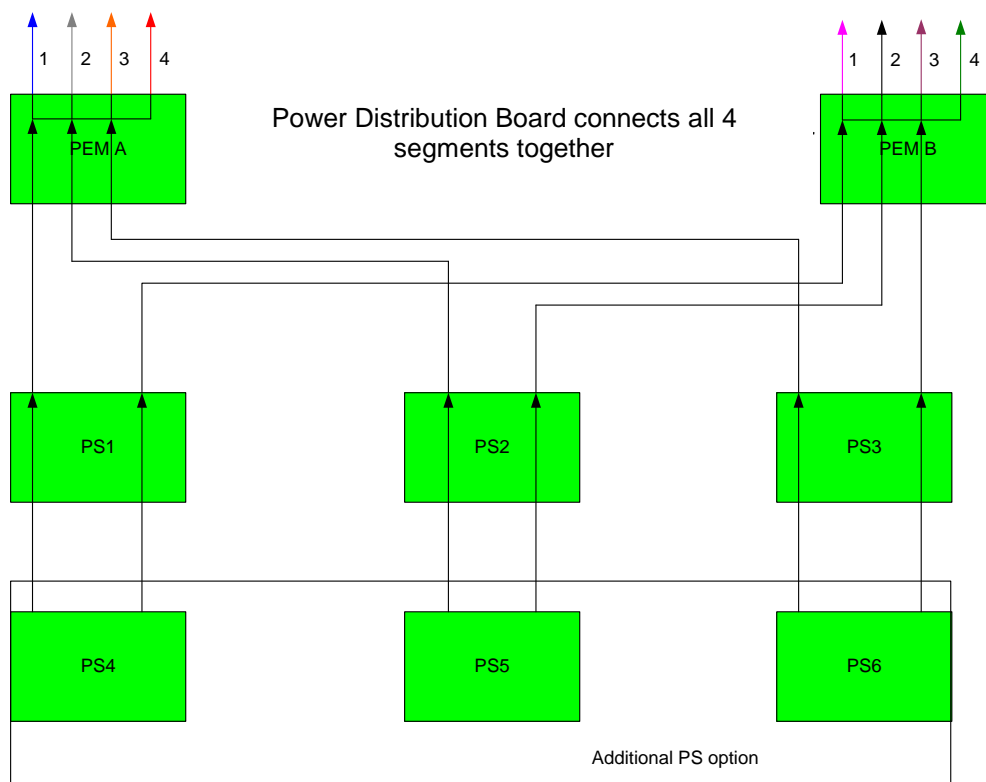


Figure 11 - AC Power Connection

Please use a power cord with the following rating:

Rated for 250 volt, 15/10 amp, 2 pole, 3 wire. Connector can be terminated to 14 thru 16 AWG (gauge) cord only. UL, CSA, VDE approved.

Female Connector IEC 60320 C13 on one end and your standard domestic AC power plug that fit's your wall AC sockets on the other end.



Figure 12 - ATCA 1500W AC Power Supply



Do not use power supplies and PEM simultaneously. In case of using an AC source, plug the power supplies in and remove the PEMs. In case of DC source, plug in the PEMs and remove the power supplies.

While using AC power, please verify the DC air block panel is removed.



Figure 13 - DC air block panel is removed

DC air block panel is removed (see figure 17 for what it looks like installed)

2.1.7 DC Power Entry Modules (PEMs)

The Power-Entry Modules (PEMs) provide power filtering and over-current protection to the SH141. Each PEM is located on a tray that slides directly into the backplane.

Each PEM (see Figure 13) provides a -48 VDC/-60 VDC input filter, and is capable of supplying 100% of shelf power.

The dual redundant EMC filtered power feeds provide common-mode and differential-mode filtering for conducted emissions.

The PEM has three indication LEDs:

1. Blue LED – Hot swap functionality
2. Power fault LED - Normally green. When red, reports 48vDC is missing
3. Status LED – Normally green. When red, reports PEM failure.



Figure 14 - ATCA DC Power Entry Module

For PEM wiring it is recommended to use Panduit, copper lug - two holes, standard barrel With 6AWG wire.

Copper lug part number: LCD6-14A-L.

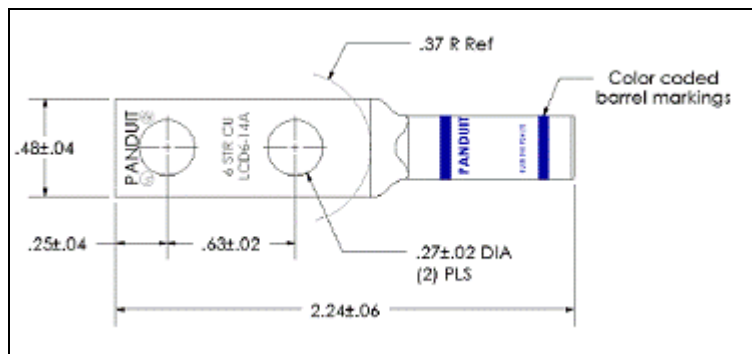


Figure 15 - Preferred Copper Lug



Do not use AC power supplies and DC PEM simultaneously. In case of using a DC source, extract the AC power supplies and install the DC PEMs. Instead of the AC PSU, please install perforated blank panels (see figure16) .

When DC PEMs are installed, AC power supplies should be removed. Instead of the AC power supplies please mount perforated PSU blank panels.

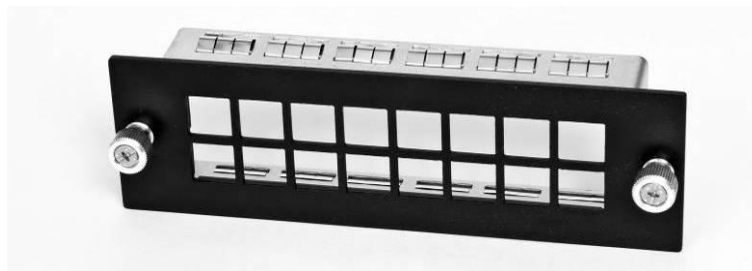


Figure 16 - perforated PSU blank panel

While using DC power, please verify the DC air block panel is installed.



Figure 17 - DC air block panel is installed

DC air block panel is installed

2.1.7.1 Redundancy

In typical installations the –48 VDC feeds are independent of each other so that if one feed fails to supply adequate power, the other feed continues to supply power through a single PEM.

See Figure 10.

The first feed (-48V A) is sourced from PEM-A (left side). The second feed (-48V B) is sourced from PEM-B (right side of the shelf). Both feeds are individually routed to each of the FRUs. The FRUs isolate the two sources to allow full redundancy.

If one PEM malfunctions, the other PEM can provide all the power needed for the platform. The PEMs are hot-swappable FRUs, so a malfunctioning PEM can be replaced without disrupting the platform normal operation.

For extraction & insertion instructions see section 4.3.2 Power Entry Module Extraction



Caution – When replacing a PEM, make sure that the power source is disconnected and insulated.



Caution - The PEM's circuit breaker has only one pole and disconnect only the -48V lead. The 48v RTN is connected constantly. It is recommended to use current protecting in the building infrastructure in order to disconnect both power leads in case of emergency.

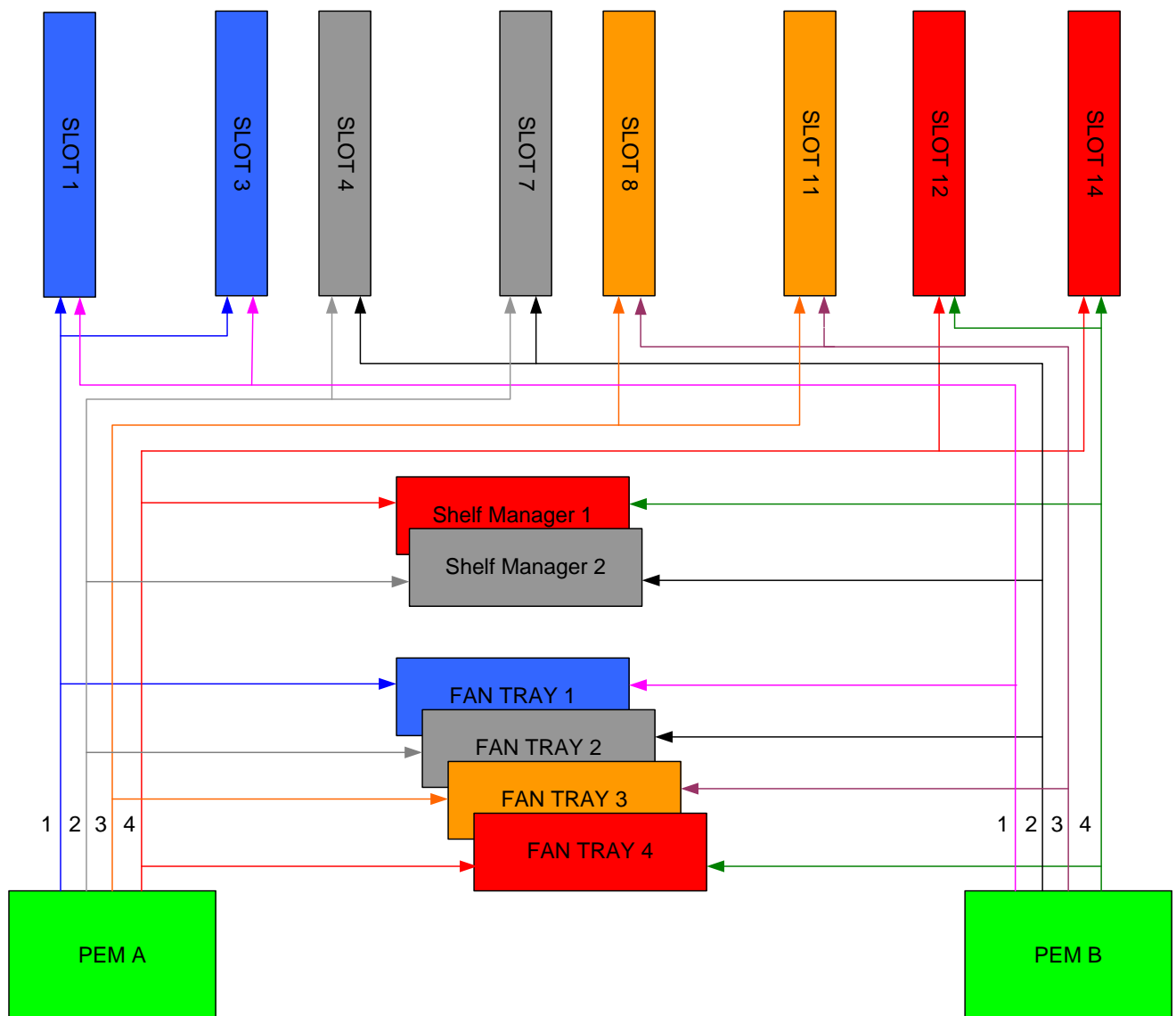


Figure 18- PEM Distribution of Power on Shelf

The -48V power feeds provide power to the backplane connector for all the front cards and FRU's.

2.1.7.2 Grounding Requirements and Power Input



When connecting ground and power cables to the shelf, follow instructions in the beginning of this document.

A readily-accessible disconnect device must be incorporated into the building's wiring between the shelf's PEM input terminals/AC power inlet and the power source. The installed breaker is determined by the voltage of the nominal input.

The supply circuit should be capable of delivering the equipment nameplate ratings of:

- In DC PEM configuration: -48V@100A or -60V@100A.
- In AC configuration: 115V@16A or 230V@8A per AC inlet.

The frame-ground cable must be a high-quality return and safety cable, no thinner than #10 AWG.

The PEMs and power supplies are hot-swappable, which means a PEM/PSU can be inserted or removed from the backplane while the system is operating. The remaining installed PEM/PSU continues to power the shelf.

- The PEM input power rating is 120A, protected by four 30A circuit breakers
- The PEM power input is divided into two power feeds, maximum current (70 A) per power feed
- Use two (2) AWG1 Power connection cables, Conductor Diameter 7.4mm, suitable for 120A per power input (double #1/4 - 20 studs) or four (4) AWG4 Power connection cables, Conductor Diameter 5.2mm, suitable for 60A per power feed (single #1/4 - 20: stud)
- Use AWG4 for Shelf Ground Connection

2.1.8 Fan Trays

The FlexChassis ATCA-SH141 features four (4) fan trays. Each fan tray contains three (3) 92x92x38 and two (2) 80x80x38 fans that supply air volume and velocity for cooling all front and rear cards including system FRU's.

The cooling power of the four fan trays can dissipate the heat generated by up to fourteen front boards and complementary RTMs. Cooling of 300W for front board and 30W for RTM, per slot is supported.

The fan tray is designed with N + 1 redundancy to meet the cooling requirements of a high-density / high-performance computing environment. In case of single fan failure, the remaining fans provide the required cooling to dissipate the heat generated by the occupied slots. It is recommended to replace a malfunctioning fan tray as soon as possible. The fan tray is factory-mounted in the SH141. It is easily replaceable, and can be replaced while the shelf is operating.

There are fan tray status LEDs on the front panel of the SH141. Each fan tray has an LED for 'FAULT' and 'STATUS'.

- The 'FAULT' LED is normally lit green. If the 'FAULT' LED is lit red, that means there is a failure in the corresponding fan tray's 48v supply or its internal 3.3v or 12v power supplies.
- The 'STATUS' LED is also normally lit green. If the 'STATUS' LED is lit red, that means there is a failure in the corresponding fan tray (i.e., a fan is not rotating).



Figure 19- Front Panel Fan Tray Status LEDs

The fan tray itself also has an LED which indicates if the fans are functioning properly. If one of the voltages (-48V_A , -48V_B or 12V or 3.3V) fails , the Power fault LED will light red (see Figure 19).

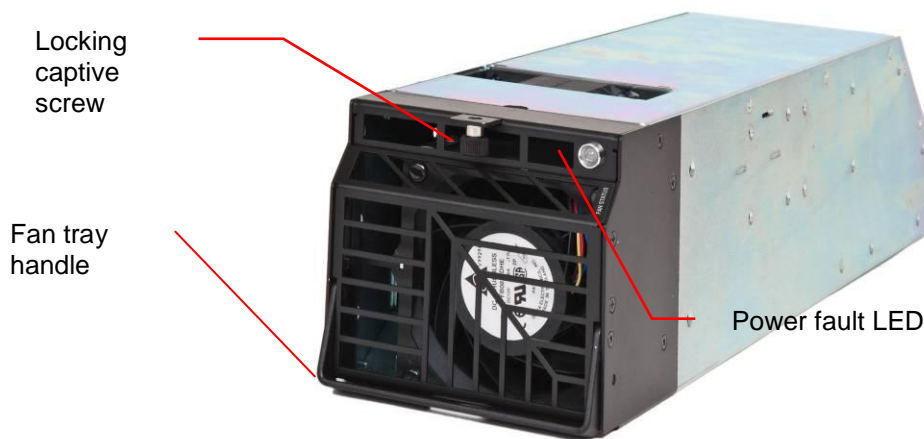


Figure 20- Fan Tray

2.1.9 Air Filter Tray

A NEBS-GR63-compatible air filter is installed on the FlexChassis ATCA-SH141. The filter is field-serviceable, and can be extracted for periodic field maintenance or replacement.

The filter is easily accessible from the front side of the card cage (by removing the front grill unit). For instructions on accessing the air filter fan tray for maintenance please see Section 4.1.2.

A shelf-based micro-switch detects the installed filter and reports its presence to the Shelf Manager.

The air filter should be cleaned periodically. Cleaning frequency relies on how dusty the operating environment is. It is recommended that the air filter be washed or replaced at least once every three months.



Figure 21 – Air filter tray

2.1.10 Blank Panels with/without air baffles

Compliance with ATCA's temperature specifications requires a steady air flow into the shelf. To ensure a steady air flow, either the FlexChassis ATCA-SH141 must be fully populated, or a blank panel must be equipped to fill every empty slot.

The "blank panel with air baffle" is designed to emulate the air flow restriction in a standard card, thus ensuring the required conditions for proper cooling.

Two types of airflow-management panels are available for the empty slots on the shelf. These include panels specifically designed for:

- Blank front module panels, with/without air baffle;
- Blank RTM panels; with/without air baffle

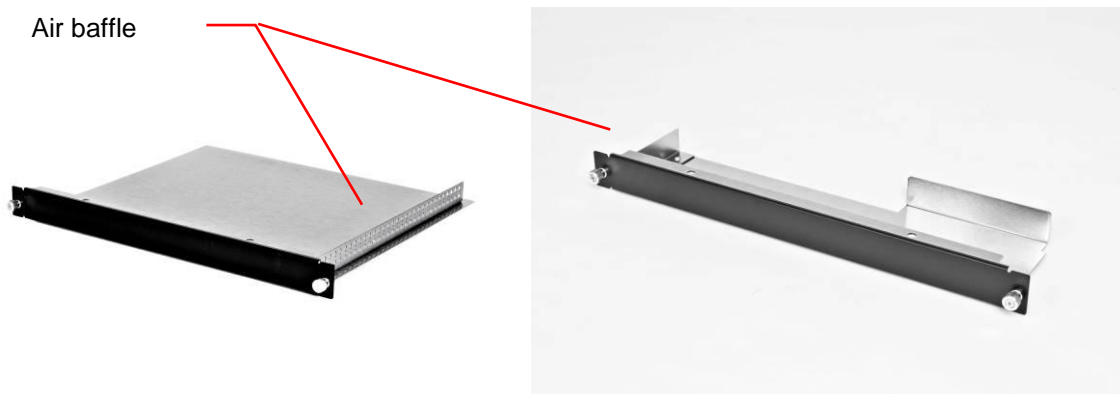


Figure 22- Blank Board Panel and Blank RTM Panel

2.1.11 Shelf ID Board

There are two hot swappable shelf ID modules, each module containing SEEPROM chip and is housed in the rear of the ATCA-SH141.

The SEEPROMs store product and manufacturer information such as shelf serial number, part number, backplane routing assignment, and shelf heat budget.

When the Shelf Manager board boots up, it compares the information stored in the two SEEPROMs:

- If SEEPROM data coincides, it is loaded and saved in the Shelf Manager board, and

the shelf initializes.

- In case of a mismatch, the data on the EEPROMs is compared with the last saved configuration in the Shelf Manager board:
 - If the saved configuration matches one of the EEPROMs it is assumed to be the right one and it is stored in both EEPROMs.
 - If the three configurations are all different, the Shelf Manager board will not boot up.



Figure 23 - Shelf ID Board

2.1.12 Cable Management

A cable holder frame can be fitted to both Top-Bottom mounting flanges of the shelf.

Top front cable
holder

Bottom front cable
holder



Figure 24 - Front cable holders

Bottom rear cable
holder



Figure 25 – Rear cable holders



Cables attached to the cable management holder must be allowed to move freely; Insure that a service loop of minimal required length is maintained.

2.2 Shelf Cooling

2.2.1 Overview

FlexChassis ATCA-SH141 complies with all the cooling requirements specified in PICMG V3.x specifications.

The cooling system consists of four high-performance fan trays. The air comes in from the front bottom to upper rear of the shelf. The fault-tolerant design is optimized for airflow of up to 300W per front card.

2.2.2 Fan Tray Design

FlexChassis ATCA-SH141 ventilation is achieved by three horizontal 92x92x38 and two vertical 80x80x38 fans, installed in the fan tray. The fans provide for n+1 redundancy.

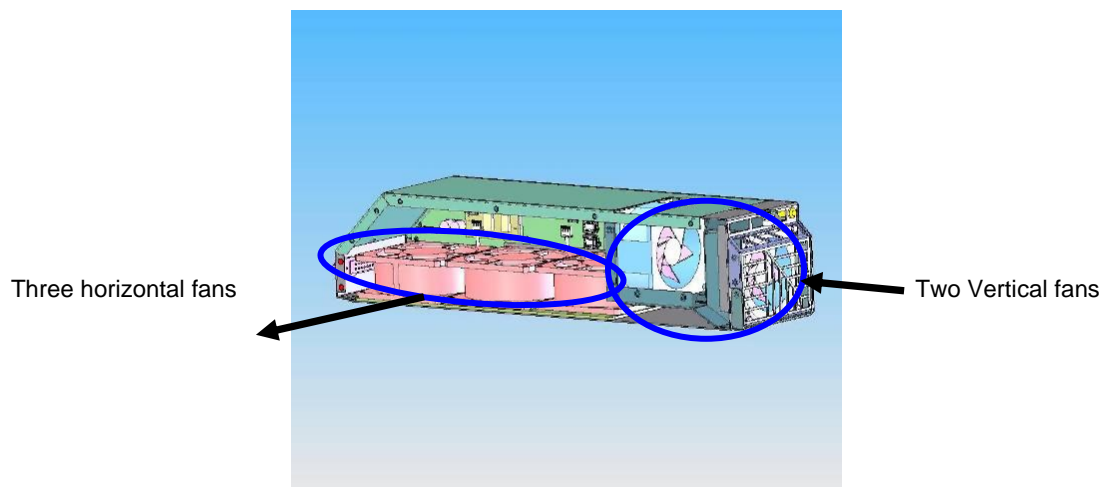


Figure 26 – Fan Tray

The fan tray connects directly to the fan card BP, where it plugs into power and control connectors. The fan tray unit is fully serviceable, and can be easily replaced without tools.

The shelf manager fully controls the fans speed based on temperature it senses across the shelf.

Cooling ability is maintained even in the case of a single fan failure. In this case, the green 'STATUS' LED of the fan tray turns red, so that it is easier to identify the tray that needs to be replaced.

2.2.3 Performance

The four fan trays supply air volume and velocity for cooling the high-density/high-performance computing environment. The cooling power of the fans can dissipate the heat generated by up to 14 front boards and complementary RTMs. 300W per front board and 30W for RTM per slot is supported.



Refrain from clogging air input and exhaust during chassis operation.

2.2.4 Fan Speed

When a fan tray is inserted into the shelf, the fans start at full speed and then decrease by steps of 7%. Under normal operating conditions, the fans run at 21% of full speed. The lower speed reduces the acoustic noise and

increases the longevity of the fans. The circuitry on the fan trays uses a pulse-width modulation to control the speed of the fans.

The speed of each individual fan is monitored. If the speed of any of the fans drops below the desired fan speed (i.e. fan failure), the other fans will speed up to compensate.

The Shelf Manager logs such events in its system event log (SEL) as a fault condition. If this occurs, replace the fan tray as soon as possible to restore fault tolerance and redundancy.

3 Installing the Shelf

This chapter provides you with instructions on how to prepare the FlexChassis ATCA-SH141 for use. You will be performing some or all of the following setup tasks:

- Site Planning
- Checking Package Contents
- Rack Mounting
- PEM Installation
- Shelf Power Up
- Shelf front and rear blades Insertion



Before installing the FlexChassis ATCA-SH141, you should be aware of what cables will be needed for equipment and power, and whether they will be connected in the front or rear of the shelf.

Prior to connecting FlexChassis ATCA-SH141, make sure that the Chassis GND cable is connected to the shelf.

3.1 Tools Required

To install the shelf in a standard 19" rack, the following tools are required:

- Standard Philips screwdriver set
- Wrench
- ESD grounding bracelet.

All the modules in the FlexChassis ATCA-SH141 are field-replaceable units (FRUs) requiring no special tools for mounting other than those mentioned above.

3.2 Site Planning



Only qualified personnel should be involved with this installation procedure.

The FlexChassis ATCA-SH141 can be installed in a standard 19" rack. All sides of the shelf should be easily accessible.

The pre-requisites for setting up the FlexChassis ATCA-SH141 for use in your facility involves:

- If a rack is used, it should be properly grounded.
- A readily accessible disconnect device must be incorporated into the building's wiring between the shelf's PEM input terminals/AC power inlet and the power source.
- The disconnect device rating required is determined by the nominal input voltage.
- To ensure sufficient airflow for the individual blades in the shelf, allow at least two inches of clearance at the side air inlets and outlets.

3.3 Checking Package Contents

The following items are included in the FlexChassis ATCA-SH141 package. Check that all items in the package are intact.



Use of equipment damaged during delivery could prevent proper functioning of the Shelf and/or cause permanent damage to it. Check all pins, screws and other components before using any of the package contents.

- Shelf chassis with backplane
- Fan trays
- Air filter tray
- Power Entry Modules (None, one or two , dependent on what was ordered)
- Power Supplies Units (none to six, dependent on what was ordered)
- Up to 3 Cable-management holders (dependent on what was ordered)



Do not use power supplies and PEM simultaneously. In case of using an AC source, plug the power supplies in and remove the PEMs. In case of DC source, plug in the PEMs and remove the power supplies.

3.4 Installation Steps

The following overall procedure is described more in detail in the sections below.

This operation should be maintained by at least two personnel.

1. Mount the shelf in the rack with eight screws.
2. Connect the shelf to the site ground with a ground cable.
3. Install the Cable-management tray holders
4. Insert a Shelf Manager board into the top slot.
5. Insert the PEMs or Power Supplies.
6. Connect the shelf to its power source.
7. In case of DC supply, power-up the shelf with the PEMs' circuit breakers on.
8. Insert front and rear cards.

3.5 Rack Mounting

You will need eight M6x10 (or longer) screws to mount the shelf on the rack.

Before you begin:

- Confirm the rack is stable so that the weight of the shelf does not cause it to tip over.
- Be sure that the job is preformed be two persons at least.

■ To mount the shelf on the rack:

- Insert the FlexChassis ATCA-SH141 chassis in the 19" rack, securing it by fastening the eight mounting screws.

The shelf should be level, and not positioned at an angle in the rack, and the rack's doors should be able to close.

3.6 Shelf Grounding

Connect rear grounding screws on the rear left side to insure that the shelf is properly grounded.



Figure 27 – Rear grounding screws

3.6.1 Installer Grounding



Any person involved in handling the shelf or card installation or replacement is required to wear an ESD grounding device.

Two grounding sockets can be found on the shelf:

- an ESD grounding socket in the front of the shelf
- an ESD grounding socket in the rear of the shelf



Figure 28 – Front ESD Socket



Figure 29 – Rear ESD Socket

3.7 PEM Installation



While the power cables are being connected to the PEM, the power source and the PEM's circuit breakers must be off.



Figure 30 – SH141 ATCA PEM

1. With the module fastening clip open, slid the module into the slot until it plugs into the backplane connector. Lock the clip in place when the module is plugged in, and fasten two tumble screws on the front side of the panel.
2. Remove the protection cover by releasing the two tumble screws on the front side of the panel.
3. Connect the power cable ends to the positive and negative poles (the hexagonal bolts on the PEM front side): the positive wire should be connected to the both bottom poles, and the negative to the both top poles.

Recommended cable specifications (6mm ring cable terminals):

- Positive wire: 48V –10AWG red wire 300/600V insulation - WEICO 10AWG 3210-2
 - Negative wire: 48V –10AWG black wire 300/600V insulation - WEICO 10AWG 3210-0
4. Make sure the power wires are firmly fastened to their poles.
 5. Replace the protection cover.

3.8 Power Supply Extraction

If Power Supply redundancy is implemented, one of the power supplies can be extracted without interfering the normal operation of the shelf.

■ To extract Power Supply:

1. Disconnect the power cables.
2. Release the two tumble screws on the front side of the power supply.
3. Fully pull out the power supply insertion lever.
4. Pull out the Power Supply.

3.9 Power Supply Insertion

If Power Supply redundancy is implemented, one of the power supplies can be inserted without interfering the normal operation of the shelf.

❏ To insert a Power Supply:

1. Push in the power supply
2. Fully push in the power supply insertion lever.
3. Verify that the power supply LEDs are illuminating.
4. Tighten the two tumble screws back in to place



Do not use power supplies and PEM simultaneously. In case of using an AC source, plug the power supplies in and remove the PEMs. In case of DC source, plug in the PEMs and remove the power supplies.

3.10 Shelf Management Card insertion

Simply insert the shelf manager card into its allocated space. Close the two tumble screws tightly. After power up, all Shelf managers LEDs should illuminate for a period of few seconds. After a few seconds, all LEDs should turn off except for the ACT and PWR LEDs which should illuminate in green. For more details refer to the "Shelf Manager for FlexChassis ATCA-SH141 (13U AC/DC, 14-slot)".

3.11 Shelf Power-Up

❏ To power up the shelf:

1. Connect the shelf to the power source.
2. In DC configuration, set the circuit breaker to the "On" position. In case of current overload, the circuit breaker will trip.
3. If applicable, connect the second PEM to a power source, and follow the previous two steps for the second PEM.
4. At power up, the fans speed will set to maximum and all LEDs on the shelf manager will illuminate. After few seconds (up to one minute) fans speeds should slow down gradually until they reach the optimum working speed. All LEDs on the shelf manager should be off except for the ACT and PWR LEDs that should be illuminated in green.

3.12 Shelf front and rear blades Insertion

Third-party cards must be ATCA-compliant.

ATCA cards should be inserted only after the installation, power-up and testing procedures of the ATCA-SH141 have been completed.

Insert the ATCA cards according to instructions, making sure they are properly-positioned in their slots and are secured to their respective connectors.

When an ATCA card is inserted and powered up, the blue LED should switch on and light steady for 10-30 seconds (depending on the card type). After that time, the blue LED should blink for about 10 seconds, and then go off.

Each ATCA card must be hot swappable. In order to initiate the hot swap process, the card extractor should be opened partially. Each ATCA card must provide a hot-swap LED. This LED can be in one of the following states:

| Indicator State | Indication |
|----------------------------|--|
| Off | The card is not ready for removal or disconnection from the shelf |
| Blue | The card is ready for removal or disconnection from the shelf |
| Blinking slowly | The card is activating itself |
| Blinking quickly | Brief deactivation has been requested |

4 Maintenance And Troubleshooting

This chapter includes instructions regarding:

- Performing Periodic Maintenance
- Handling Electromagnetic Interference
- Extracting Modules
- Handling Alarms
- LED Functions: Application-defined LEDs

| LED | Status | Meaning |
|-----|----------------------------|---------------------------|
| A | Green/ red/ bi-color | As defined by application |
| B | Green/red/ | As defined by application |
| C | Amber/red/ | As defined by application |

- Hot-swapping FRUs
- Resetting the system
- Troubleshooting

As required by the ATCA standard, the ATCA-SH141 applies a fully hot-swappable approach. Assuming redundancy has been provided for (i.e., two shelf managers units, and two PEMs or multiple AC power supplies), all of the shelf assemblies can be field-replaced with no interruption to service.

Visual alarms provide clear indication of trouble, for easy problem location.

Malfunctions can be responded to quickly and easily, as no field repair is necessary. Failed modules can be easily extracted and replaced with no tools or with a minimal set of tools.

4.1 Performing Periodic Maintenance

This section provides procedural instructions on servicing or replacing shelf components.

Maintenance of the FlexChassis ATCA-SH141 involves the following tasks:

- Fan Tray Visual Inspection
- Air Filter Cleaning and Replacement.
- Verify all LED's on front and back of the shelf are green, representing status OK.

4.1.1 Fan Tray Visual Inspection

The fan trays should be checked periodically for any visible damage that could prevent or disrupt normal fan operation. Fan trays Status indicators on the front and rear should be green to indicate there is no malfunction.

See Section 4.3.5 for instructions on replacing a fan tray.

4.1.2 Air Filter Cleaning and Replacement

The air filter should be checked regularly. If environmental conditions are good, it may be enough to extract the filter and vacuum clean it. Otherwise it might be necessary to replace it.

The air filter can be ordered separately (i.e., without the metal tray).

Air filter cleaning must be performed in a different location from where the shelf is placed.

The air filter can be extracted without interrupting power. Release the two tumble screws on the front side of the grill unit (A) and extract the unit by pulling the two tumble screws. Release the air filter screw, as shown in B and pull it out.



Figure 31 – Air Filter Removal

4.1.2.1 Clean or Replace

Filters containing reusable (open cell polyurethane foam) media should be cleaned or replaced every three to six months. This filter media may be cleaned with slightly compressed air, vacuumed, and/or rinsed with clean water. If a degreaser is required, use only a mild detergent, such as, dishwashing liquid. Avoid using harsh solvents or cleaning agents. Even though this type of filter may be cleaned, replacement is recommended every two to three years to ensure media durability and eliminate residual dust build-up and subsequent air flow resistance.

4.1.2.2 General Guidelines

It is not recommended to store air filters for several months or years at a time. Instead, purchase cost-effective quantities and keep sufficient inventories for no more than a few months. Filters seem to have improved permanence in an operating situation with air movement and ventilation.

Although the life spans of the filters cannot be forecasted, on average, across-the board air filter applications, the above mentioned recommendation will yield optimal filter performance and reduce equipment risk. Depending upon the application, environment, handling, maintenance and care of the filter media, service life ranges may be more or less.

4.2 Handling Electromagnetic Interference

The shelf emits electromagnetic waves that may interfere with nearby equipment. Conversely, nearby electronic equipment may emit electromagnetic waves that interfere with the shelf. The EMC, EMI, and RFI specifications of the shelf and all nearby equipment should be considered when choosing the placement of the platform and surrounding equipment.

In the shelf and most other equipment, the use of fillers panels in unoccupied slots is necessary to keep the product's emissions within their specified limits.

- Install front and rear fillers panels into any empty slots.
- Do not use blank faceplates in place of fillers.
- Keep slots populated with active modules directly next to each other and fillers directly adjacent to the outermost active modules.
- If the shelf experiences unexpected and intermittent data errors, carefully consider the possibility of electromagnetic interference from nearby equipment as a possible source of the problem.

If your system configuration does not populate all front slots with active blades, you must fill those empty slots with additional blades or slot flow blocker blades to maintain system airflow and electromagnetic shielding integrity. Fillers panels can be ordered separately.

4.3 Extracting/Inserting Modules

4.3.1 Front ATCA Card Extraction

➔ **To extract a front ATCA card:**

1. Pull the module's insertion lever slightly.
The de-activation sequence begins.
2. After the module's blue LED lights steady, pull out the front card extractor lever.
3. Pull out the front card.

4.3.2 Power Entry Module replacement

If PEM redundancy is implemented, one of the PEMs can be extracted without stopping service.

➔ **To extract a PEM:**

1. Turn off the circuit breakers.
2. Turn off external power to the PEM.
3. Remove the protection cover.
4. Disconnect the power cables.
5. Fully pull out the module's insertion levers.
6. Pull out the module.



➔ **To insert a PEM:**

1. Turn off the circuit breaker.
2. Push in the module.
3. Fully push in the module's insertion lever.
4. Connect the power cables.
5. Re-mount the protection cover.
6. Turn on power to the PEM by Turning on the Circuit Breaker.

4.3.3 Shelf Manager Board Insertion

➔ **To insert a shelf manager:**

1. Push the module inward carefully.
2. Push the insertion lever inward, making sure it goes fully in to the niche.
3. The blue LED should start to blink until the shelf manager confirms that its checksum is identical to the EEPROMs.
4. After the module's blue LED turns off (data match), the module is active.

4.3.4 Shelf Manager Board Extraction

➔ **To extract a shelf manager:**

1. Pull the module's insertion lever slightly.
The de-activation sequence begins.
2. After the module's blue LED lights steady, pull out the module's insertion lever.

3. Pull out the module.

4.3.5 Fan Tray Replacement

The shelf should be used only with a fully-operational fan tray. A malfunctioning fan tray should be replaced immediately, in order to prevent thermal damage to the installed ATCA application cards.



Use care when handling the fan trays, and do not handle them from the connectors. Improper handling of the fan trays could cause damage to the connector pins.

Do not handle a fan tray while the fans are operating.

➔ To replace the fan tray:

1. Without interrupting power, release the tumble screw on the top Back side of the fan tray, and pull slightly out.
2. Wait for the full stop of the fans (could take a few seconds).
3. Extract the tray by pulling the handle, as shown below:



Figure 32 – Extracting a Fan Tray

4. Insert the replaceable fan tray unit.
5. Lock the fan tray by using the tumble screw.
6. The status LED should be lit red and after a few seconds should turn green.

4.3.6 Shelf ID modules Replacement

Shelf ID modules are generally installed and handled only in the factory. Follow the procedure below in the rare case that it becomes necessary to field replace the Shelf ID modules.

➔ To replace a Shelf ID modules:

1. Without disconnecting the power, release the two tumble screws and pull the module out. (as shown in Figure 32).
2. Replace the unit with a new Shelf ID module.



Figure 33 – Shelf ID Module Replacement

4.4 Handling Alarms

Both visual indicators and software alarms are provided.

4.4.1 Visual Alarms

Nine LEDs at the front of the Shelf Management card provide visual alarms.

LED Functions: General LEDs

| LED | Status | Meaning |
|---------------|---------------|--|
| ACT | Green | Shelf manager is active |
| | Red | Shelf manager failure |
| | Green Blink | Shelf manager is inactive |
| PWR | Green | Local voltage supply on Shelf manager is good |
| | Off | Local voltage failure |
| HS (hot swap) | Steady Blue | Shelf manager is powering up or ready for extraction |
| | Blinking blue | Shelf manager hot swap process |
| | Off | Shelf manager is operating |

Figure 34 – General LEDs

LED Functions: Telco Alarm LEDs

| LED | Status | Meaning |
|----------------|--------|--------------------|
| CRT (Critical) | Off | Normal operation |
| | Red | System alarm event |
| MJR (Major) | Off | Normal operation |
| | Red | System alarm event |
| MNR | Off | Normal operation |

| | | |
|---------|-----|--------------------|
| (Minor) | Red | System alarm event |
|---------|-----|--------------------|

Figure 35 – Telco Alarm LEDs

Upon completion of boot-up, LEDs will display as follows:

| General LEDs | | Telco Alarm LEDs | Application Defined LEDs |
|--------------|--|------------------|--------------------------|
| ACT | return to normal state | OFF | OFF |
| PWR | Remains ON | | |
| HS | Lights steady blue for a few seconds, then begins blinking, then goes off after a few blinks | | |

Figure 36 – LEDs status when Shelf Manager boot-up completely

4.4.2 Software Alarms

The FlexChassis ATCA-SH141 supports software alarms according to *PICMG Specifications 3.0*. Please refer to these specifications for a detailed description.

| LED | Status | Meaning |
|-----|----------------|---------------------------|
| A | Green/ red/ | As defined by application |
| B | Green/red/ | As defined by application |
| C | Green/red/ | As defined by application |

Figure 37 – Application-Defined LEDs

4.5 Hot-Swapping FRUs

All the active components in the platform are mounted on (or housed in) field-replaceable units (FRUs) that you can easily remove and replace. The subrack, backplane, and other non-FRUs do not contain active components.

All FRUs are hot-swappable: you can remove and insert a FRU without shutting down any other shelf component. Hot swapping facilitates planned maintenance activities and FRU replacement.

The platform includes front-panel LEDs and a Telco alarm, which can be configured to activate when a hardware or software failure occurs. If an external alarm system is connected to the platform, it will also be activated for the alarm condition. The alarms alert an operator or technician to replace a failed FRU or perform some other maintenance operation.

The following procedures are to be used when modules are hot-swapped.

➤ To remove a module:

1. Partially open the module's right ejector latch to activate the module's hot-swap switch.

The module's IPMC sends to the Shelf Manager a request to deactivate, and the blue hot swap LED blinks at a fast rate.

2. The Shelf Manager determines whether the module can be extracted. If it can, the Shelf Manager grants permission to the IPMC.
3. The IPMC disables the interfaces that are controlled by electronic keying, and shuts down the module's operations. It then notifies the Shelf Manager the deactivation is complete. The blue LED remains lit.
4. Extract the module.
5. The Shelf Manager reclaims the module's power budget. Also, as part of electronic keying, the Shelf Manager disables—on other modules—the interfaces that are only shared with the deactivated module.

4.6 Resetting the System

One or both of the following reset options should be used if the shelf manager card is not responding. (The second step should be performed only if the first one has not solved the problem.)

1. Press the Reset button on the Shelf Manager card front panel.
2. Extract the Shelf Manager card from the shelf (in case of one Shelf Manager card installed), and re-insert it.

4.7 Troubleshooting

The following table summarizes potential problems and recommended solutions.

| Problem | Probable cause | Solution |
|---|---|--|
| <ul style="list-style-type: none"> Shelf manager does not boot up properly: One or more of the LEDs fails to light during boot-up. The LEDs fail to return to their status as described in Section 4.4.1, above. The blue LED does not blink. | <ul style="list-style-type: none"> Shelf manager is not in fully inserted in the cage. Shelf Manager malfunction. | <ul style="list-style-type: none"> Check that the shelf manager board is properly inserted in the cage; Verify that the ejector clip is closed. Replace the Shelf Manager. |
| <ul style="list-style-type: none"> Fans fail to operate at power up | <ul style="list-style-type: none"> Fan tray is not in fully inserted in the cage. Shelf manager is not in fully inserted in the cage. Shelf manager malfunction. Fan tray card malfunction. | <ul style="list-style-type: none"> Replace the fan tray. Replace the Shelf Manager. |
| <ul style="list-style-type: none"> Fan speed does not decrease after boot-up is completed | <ul style="list-style-type: none"> Shelf Manager board malfunction. | <ul style="list-style-type: none"> Replace the shelf manager. |
| <ul style="list-style-type: none"> Fan tray LED is lit red | <ul style="list-style-type: none"> One or more of the fans are not working. Logic malfunction. | <ul style="list-style-type: none"> Pull the fan tray slightly out for few seconds until all fans stop spinning, and re-insert it. Replace fan tray. Replace Shelf Manager board following this sequence: <ul style="list-style-type: none"> Insert a second Shelf Manager board in the redundant slot; Issue a switchover command to switch shelf control from the current Shelf Manager board to the redundant one; |

| | | |
|---|---|--|
| <ul style="list-style-type: none"> • Circuit Breaker trips off | <ul style="list-style-type: none"> • Shelf power trouble. | <ul style="list-style-type: none"> • Remove all ATCA blades and shelf managers to isolate the malfunction. • Replace Power Entry Module. |
| <ul style="list-style-type: none"> • Boot sequence does not complete, and the blue LED continues to blink after the Shelf Manager card has been replaced and all relevant monitor commands have been performed | <ul style="list-style-type: none"> • One of the Backplane's connectors is damaged. • One of the cage units, or the ATCA board, does not fit properly in the cage. | <ul style="list-style-type: none"> • Replace SEEPROMs; if you have not yet done so; • Replace chassis. |

5 System Specifications

This chapter documents the product's standards certification, and physical and other technical specification parameters.

5.1 Certification

The FlexChassis ATCA-SH141 is designed to support NEBS level-3, CE, FCC and UL. It complies with the following:

- Advanced TCA, PICMG 3.x
- IPMI v 1.5. ; v 2.0

5.2 Technical Data

The following table presents technical specifications for each of the product elements.

| Category | Property | Description/Value |
|----------------------|-----------------------------------|---|
| Physical | | |
| | Number of slots | 14 slot 8Ux280mm, front blades; 14 slot 80mm, RTMs |
| | Dimensions | 578mm (22.75") (13U) H x 448mm (17.637")W (19" rack mount) x 385.57mm (15.18") D Not including handles & cable holders |
| | EMI | EMI gasketing and hardware spacing to support FCC part B |
| | Weight – Empty chassis | 22Kg (shelf and Backplane, Air filter, Cable Management only) |
| | Weight – Assembled chassis | 39Kg (Including PEMs, Fans, 2 x shelf managers) |
| | Compliance | PICMG 3.0; R.2.0 |
| | Temperature | Humidity: 5% to 95%, non-condensed Storage Temperature: -40° to +70° Celsius Operating Temperature: -5° to +55° Celsius |
| | Other | Front and rear ESD jack Front rack flanges Front cable management tray |
| Accessibility | | |
| | Front | Shelf Manager, Front boards, Air Filter Tray, top and bottom cable management. |
| | Rear | Fan trays, PEMs, RTMs, shelf ID, cable management. |
| Backplane | | |
| | Bus Architecture | Up to 14 ATCA-compliant front boards, dual star, dual redundant Shelf Manager boards, bussed IPMB. |
| | Base interface | Base channel interconnect between two ATCA slots, with support for 10/100/1000 BASE-T Ethernet; base channel 1 is allocated to Shelf Manager board |
| | Fabric interface | Dual star fabric connectivity optimized for performance at 10Gbps per pair (40Gbps per channel) |
| | Hub/Node slots | 2 logical slots 7 and 8 |
| | Update channels | Physical slot 1-3, 2-4, 5-9, 6-10, 7-8, 11-13, 12-14 |
| | IPMB support | Dual redundant, full IPMB support with shelf manager |
| Power | | |
| | AC Power Supply | Three front redundant, self cooled, hot swappable, integral power supplies. Input power 90 – 240 VAC (six power supplies version is also available) |
| | DC input (Nominal) | -48 VDC/-60 VDC; one feed per PEM (A or B), designed to carry 4 x 30Amp |
| | EMC filtering | Dual redundant EMC filtered power feeds; PEMs provide common-mode and differential-mode filtering for conducted emissions, reducing differential-to- common-mode conversion. |
| Cooling | | |
| | Number of fan trays | Four hot pluggable fan trays, 5 axial fans per tray, for front and RTM slots. |
| | Redundancy per fan tray | N+1 (i.e., any one fan can fail with no service degradation) |
| | Fan speed | Variable speed under shelf manager control |
| | Cooling capacity | 300 Watt per front board, 30W per RTM slot |
| | Air Filter | Front washable field replaceable NEBS GR63 compatible air filter |
| Alarm I/O | | |

| | | |
|-------------------|--|--|
| | Electrical/Mechanical Placement | Dual redundant Alarm I/O Modules accessible from front of shelf |
| | Alarm I/O interfaces | 15-pin MicroDA-15P connector. Supports 4 outputs (Major, Minor, Critical, Power) and 2 inputs (Major and Minor Reset) |
| Regulatory | | |
| | Safety | Designed to meet UL, TUV requirements |
| | CE & FCC | Designed to meet CE and FCC part 15 requirements |
| | Environment | Designed to be compatible with NEBS level-3 and ETSI |
| Other | | |
| | Shelf Identity | Configuration board with on-board EEPROM stores shelf serial number, part number, backplane routing assignments, shelf heat budget and other data. |

5.3 Acronyms Used in this Manual

| Acronym | Meaning |
|-------------|--|
| ATCA | Advanced Telecom Computing Architecture |
| FRU | Field-Replaceable Unit |
| HS | Hot swap |
| PEM | Power Entry Module |
| IPMB | Intelligent Platform-Management Bus |
| IPMI | Intelligent Platform-Management Interface |
| RTM | Rear Transmission Module |
| NEBS | Network Equipment-Building Systems |
| ShMC | Shelf Manager board |
| ETSI | European Telecommunications Standards Institute |
| ANSI | American National Standards Institute |
| CE | "Conformité Européene" ("European Conformity") |
| PSU | Power Supply Unit |
| FCC | Federal Communications Commission |
| UL | Underwriters Laboratories - safety standards |
| CFM | Cubic Feet per Minute – Airflow measurement unit |